



A new deepwater goby of the genus *Discordipinna* Hoese & Fourmanoir, 1978 (Teleostei: Gobiidae) from Kumejima of the Ryukyus, Japan*

I-SHIUNG CHEN^{1,4}, TOSHIYUKI SUZUKI^{2,4} & KWANG-TSAO SHAO^{3,5}

¹Institute of Marine Biology & CMBB, National Taiwan Ocean University, Keelung 202, Taiwan, ROC. (email: isc@mail.ntou.edu.tw)

²Kawanishi-midoridai Senior High School, 1-8 Kouyoudai, Kawanishi, Hyogo 666-0115, Japan
(email: trimma-toshiyuki@hop.ocn.ne.jp)

³Biodiversity Research Center, Academia Sinica, Taipei, Taiwan, ROC. (email: zoskt@gate.sinica.edu.tw)

⁴Both authors contributed equally to this paper.

⁵Corresponding author

* In: Naruse, T., Chan, T.-Y., Tan, H.H., Ah Yong, S.T. & Reimer, J.D. (2012) Scientific Results of the Marine Biodiversity Expedition — KUMEJIMA 2009. *Zootaxa*, 3367, 1–280.

Abstract

A new goby species of *Discordipinna* was collected by trawling from the deep waters off Kumejima, the Ryukyu Islands, Japan. The new species, *Discordipinna filamentosa*, can be well distinguished from the only other described species, *D. griessingeri* Hoese & Fourmanoir, 1978, by the following unique combination of features: (1) fins: first dorsal fin rays VI; pectoral fin rays 16; and first dorsal fin with the longest, filamentous first ray in male extending far beyond caudal fin base when adpressed; (2) squamation: longitudinal scale rows 26; transverse scale rows 8 and predorsal naked; (3) dorsal pterygiophore formulae 3/122101/9; (4) head lateral-line system: a longitudinal pattern of infraorbital papillae and both anterior oculoscapular canal and preopercular canal present, lacking posterior oculoscapular canal; and (5) its distinctive coloration. An artificial key to species of *Discordipinna* is also provided.

Key words: *Discordipinna*, Gobiidae, new species, Kumejima, Japan

Introduction

Fishes in the family Gobiidae belong to one of largest group of marine teleost fishes in the World (Miller 1988; Wu 2008). The coral reef-associated gobiid genus, *Discordipinna* Hoese & Fourmanoir, 1978, is a very small-sized goby with a longitudinal infraorbital papilla pattern (Hagiwara *et al.* 1996; Akihito *et al.* 2002; Motomura & Matsuura 2010). The type species of the genus is *Discordipinna griessingeri* Hoese & Fourmanoir, 1978, with the holotype collected in the Gulf of Aqaba, Red Sea and other type series and recent records from the West Pacific including Indonesia, the Philippines as well as Japan (Hagiwara *et al.* 1996; Akihito *et al.* 2002).

In the 2009, Kumejima Expedition of Japan, a single gobiid specimen was collected by trawling net during deepwater marine biodiversity collections of the coral-reef region. This species was considered new by Suzuki & Shibukawa (2004), based on a series of underwater photographic records of by Japanese scuba divers. The aims of this paper are to present a formal description of this very rare new species as well as provide a diagnostic key for of *Discordipinna* species in the Indo-Pacific region.

Materials and methods

The type specimen of the new goby was collected by using a 1 m beam trawl from deepwater habitat with coral rubbles off Kumejima, Ryukyu Islands of southern Japan. Other comparative congeneric specimens were collected by scuba diving.

All the counts and measurements were made from specimens preserved in 70% ethanol after fixation of 10% formalin. Morphometric methods followed Miller (1988) except the length of first dorsal-fin rays; meristic methods followed Akihito *et al.* (1984), Chen & Fang (2006) and Chen & Miller (2008). Terminology of head sensory canals and free neuromast organs (sensory papillae) were from Wongrat & Miller (1991) based on Sanzo (1911).

Meristic abbreviations are as follows: A = anal fin; C = caudal fin; D1 = first dorsal fin; D2 = second dorsal fin; LR = longitudinal scale rows; TR = transverse scale series from second dorsal fin origin to anal fin; V = pelvic fin; and VC = vertebral count. All fish lengths are expressed as standard length (SL).

The type specimen of this new species is deposited at the National Museum of Nature and Science, Tokyo, Japan (NSMT). Other congeneric material and photographs are deposited at Kanagawa Prefectural Museum of Natural History, Kanagawa, Japan (KPM) and the Pisces collections of National Taiwan Ocean University, Keelung, Taiwan (NTOUP).

Systematics

Discordipinna griessingeri Hoese & Fourmanoir, 1978

(Japanese name: Homura-haze)

(Fig. 1)

Discordipinna griessingeri Hoese & Fourmanoir, 1978: 21 (El Himeira, Sinai, Egypt, Gulf of Aqaba, Red Sea). — Hagiwara *et al.* 1996: 2. — Akihito *et al.* 2002: 1250. — Suzuki & Shibukawa 2004: 443. — Motomura *et al.* in Motomura & Matsuura 2010: 208.

Materials examined. NTOUP-2011-01-001, 3 specimens, 13.3–13.7 mm SL, Cebu Island, the Philippines, coll. A. Chen *et al.*, 8 Nov., 2009.



FIGURE 1. *Discordipinna griessingeri*, NTOUP-2011-01-001, 13.7 mm SL, Mactan Island, Cebu, Philippines. Photograph by Shih-Pin Huang.

Diagnosis. This species can be well distinguished from congeners by the unique combination of the following features: (1) fins: first dorsal fin rays V; pectoral fin rays 17–20 (modally 18); and first dorsal fin with the longest anterior two rays in male and the fin membrane deeply indented between the first two dorsal spines; (2) squamation: longitudinal scale rows 22–25; transverse scale rows usually 6–7 and predorsal naked; (3) dorsal pterygiophore formulae $3/4/1001/8$; $10 + 16 = 26$ vertebrae; (4) head lateral-line system: reduced, longitudinal pattern of infraorbital papilla and anterior oculoscapular canal present (with pore λ singular on middle of interorbital region, pore κ singular on posterior interorbital region and lateral section as pores α , β , and ρ) but lacking both preopercular and posterior oculoscapular canals; and (5) coloration pattern: body creamy yellow with wide longitudinal brown band on ventral half; head with many round brownish black spots; first dorsal fin orange red; pectoral fin orange with an oblique translucent band; second dorsal and caudal fins with several deep brown blotches each having a central black spot.

Distribution. This species is distributed from the Red Sea, the Indian Ocean to the tropical West Pacific region in countries including the Philippines, Malaysia, Indonesia, Taiwan, Japan (Ryukyu Islands to Wakayama Prefecture, middle of the main island, Japan) (Hagiwara *et al.* 1996; Akihito *et al.* 2002; Suzuki & Shibukawa 2004; Chen unpublished data).

***Discordipinna filamentosa* n. sp.**

(New Japanese name: Naginata-haze)

(Figs. 2–4)

Discordipinna sp. 1. — Suzuki & Shibukawa 2004: 444.

Material examined. Holotype. NSMT-P104037, 15.7 mm SL, Trawl 7, 80–82 m depth, GPS 26°23.090' N, 126°47.832' E, 1 m Beam Trawl, Kumejima, Okinawa Island, the Ryukyu Islands, Japan, coll. Liao Y.C. *et al.*, 11 Nov. 2009.

Photographic records from Image Database of Fishes in the Kanagawa Prefectural Museum of Natural History, Japan (KPM-NR). (A) Kumejima, the Ryukyu Islands, Japan: KPM-NR 36520, 64 m depth, H. Kobayashi, 26 Jun. 2000. (B) Okinawajima, the Ryukyu Islands, Japan: KPM-NR 38565, 37 m depth, U. Adachi, 3 Aug. 2000. (C) Tsutomezaki, Kashiwajima Island, Shikoku, Japan: KPM-NR 33814, 55 m depth, S. Kubo, 11 Oct. 1999. (D) Borneo Island, Malaysia: KPM-NR 22220, 30 m depth, F. Konno, 2 Jan. 1997.

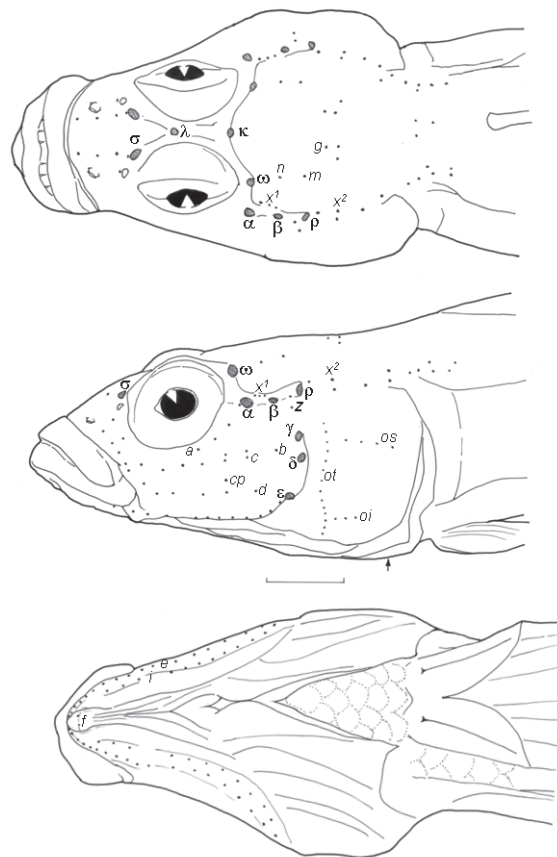


FIGURE 2. Head lateral-line system of *Discordipinna filamentosa*, NSMT-P10437, male, holotype, 15.7 mm SL, Kumejima, the Ryukyu Islands, Japan. The arrow indicates the ventral limit of gill-opening. Illustration by I-Shiung Chen. (Bar = 1 mm)

Diagnosis. *Discordipinna filamentosa* n. sp. can be well distinguished from the only other described species, *D. griessingeri* Hoese & Fourmanoir, 1978, by the following unique combination of features: (1) fins: first dorsal fin rays VI; pectoral fin rays 16; and first dorsal fin with the longest, filamentous first ray in male extending far beyond caudal fin base when depressed; (2) squamation: longitudinal scale rows 26; transverse scale rows 8 and

predorsal naked; (3) dorsal pterygiophore formulae 3/122101/9; $10 + 16 = 26$ vertebrae; (4) head lateral-line system: a loosely arranged, longitudinal pattern of infraorbital papilla and anterior oculoscapular canal present (with median pore λ singular on middle of interorbital region, lateral section as pores α , β , and ρ) and preopercular canal (with three pores γ , δ and ϵ), lacking posterior oculoscapular canal; and (5) distinctive coloration: body generally creamy white; head with a snow-white oblique band from upper lip to upper part of opercle; dorsal side of snout scattered with tiny, densely-set tiny orange to brown spots; trunk with three lateral, oblique orange to brown bands which generally fused ventrally, and lateral body with 4–5 thin longitudinal yellow stripes; first dorsal fin yellow with 12 major transverse deep brown bands mainly on filamentous portion of the fin and an oval translucent mark on basal portion of that; second dorsal fin yellow with about four rounded gray blotches each having a central deep black spot against yellow background; caudal fin yellow with a shallow “C” shaped snow-white mark basally and several round deep black spots on upper half; anal and pelvic fins entirely deep black; and pectoral fin with a snow-white wedge.

Description. Body proportions are described in Table 1. Body subcylindrical anteriorly, compressed posteriorly. Head moderate large, snout somewhat pointed in lateral view. Eye large, dorsolateral. Mouth somewhat oblique about 40 degrees to horizontal line, the rear margin extending slightly beyond vertical of anterior margin of eye. Lower lip anteriormost. Both jaws with 2–4 rows of tapered sharp teeth, and outer rows enlarged. Anterior nasal pore a short tube and posterior nasal pore a round opening. Gill-opening restricted, extending forward ventrally somewhat beyond a vertical at upper edge of the opening. Dorsal pterygiophore formula 3/122101/9. $10 + 16 = 26$ vertebrae.

Fins. First dorsal fin rays VI; second dorsal fin rays I/8; anal fin rays I/8; pectoral fin rays 16. First dorsal fin elongate with the longest, filamentous first ray in male extending far beyond caudal fin base when adpressed. Origin of anal fin inserted just below origin of first branched ray of second dorsal fin. Rear tips of second dorsal and anal fins when adpressed do not reach procurent rays of caudal fin. Pectoral fin rather large (32.1% in SL) and oblong, the rear margin extending beyond the vertical of origin of anal fin. Pelvic fin long (35.1% in SL) with large frenum and membrane around its spinous rays bilobed. Rear tip of pelvic fin extending beyond the vertical through anus. Caudal fin large (40.4%), elliptical with fin length longer than the head length.

Scales. Body with rather large ctenoid scales; belly scales cycloid; longitudinal scale rows 26; transverse scale rows 8; predorsal scale 0. Prepelvic and belly with cycloid scales. Head and predorsal region entirely naked.

Head lateral-line system. Canals: Anterior oculoscapular canal extension with anteriorly paired terminal pores σ slightly behind posterior nasal pore. Pore λ singular on middle of interorbital region; pore κ singular on rear dorsal vertical of orbit beyond pore λ . Paired pores ω behind eyes on nape. Lateral extension of anterior oculoscapular canal behind orbit as pore α , followed by middle pore β and terminal pore ρ . Preopercular canal present, with three pores: dorsally terminal pore γ ; middle pore δ and ventrally terminal pore ϵ .

Papillae: Cheek with loosely arranged, longitudinal infraorbital papillae. Row *a* very short with four papillae, not extending to vertical through middle of eye. Row *b* short, merely with three papillae. Rows *c* and *d* longer with more papillae in row *c*, and row *c* extending posteriorly to vertical through pore α . Opercle with three main rows as rows *os*, *ot* and *oi* with both rows *ot* and *oi* slightly separated. Row *f* as paired papillae. Other papillae rows shown in detail as in Fig. 1.

Colouration in freshly preserved specimen. Body with generally creamy white background. Head creamy yellow to orange pinkish and an oblique, snow-white band from upper jaw to lower part of eye, then horizontally to posterior region of head to upper region of opercle. Dorsal side of snout and upper part of orbit scattered with tiny, densely-set orange to brown spots. Trunk with three rather oblique orange to brown bands which generally fuse ventrally, and lateral body with 4–5 very thin, longitudinal yellow stripes.

First dorsal fin light yellow with 12 major transverse deep brown bands mainly on filamentous portion of the fin and an oval translucent mark on basal portion of that. Second dorsal fin yellow with a translucent, longitudinal band on lower half region and also with four main gray marks each having a central deep black spot against yellow background. Caudal fin yellow with a shallow “C” shape snow-white mark, distal region with thin deep black margin surrounded by a thin snow white margin. Several round deep black spots on upper half of caudal fin membrane with the largest on upper region. Anal fin entirely deep black. Pelvic fin entirely deep black except anterior basal region in orange gray. Pectoral fin with a snow-white oblique, wide triangular wedge; upper 1/2 region of fin membrane with several tiny deep black spots.

TABLE 1. Morphometry of holotype of *Discordipinna filamentosa*.

Cat. No.	NSMT-P10437
Standard length (mm)	15.7
% Standard length	
Head length	32.5%
Predorsal length	36.8%
Snout to 2nd dorsal length	57.8%
Snout to anus	61.4%
Snout to anal fin origin	64.6%
Prepelvic length	28.8%
Caudal peduncle length	17.8%
Caudal peduncle depth	8.2%
1st dorsal fin length	80.3%
1st dorsal fin base	13.2%
2nd dorsal fin base	22.7%
Anal fin base	19.5%
Caudal fin length	40.4%
Pectoral fin length	32.1%
Pelvic fin length	35.1%
Body depth at pelvic fin origin	15.1%
Body depth at anal fin origin	12.3%
Body width at anal fin origin	6.3%
Pelvic fin origin to anus	32.8%
% Head length	
Snout length	29.2%
Eye diameter	24.9%
Cheek depth	19.8%
Postorbital length	53.6%
Head width in maximum	54.8%
Head width in upper gill	27.8%
Bony interorbital width	2.3%
Fleshy interorbital width	10.0%
Lower jaw length	25.6%
% Caudal peduncle length	
Caudal peduncle depth	61.9%

Distribution. So far, the single specimen was collected from the deepwater trawling of up to 82 m depth off Kumejima, Ryukyu, Japan. However, some underwater photographic records taken by Japanese scuba divers have provided live images of this species around Kashiwajima, Shikoku, Japan; Okinawajima, the Ryukyu Islands, Japan; and Malaysia. Based on scuba diving witness and current trawl specimen record, it seems to live in 30 to 82 m depth water with substratum of coral-reef hard debris.

Etymology. The specific name referred to Latin-“*filamentum*” meaning the thread-like elongation of fin, a diagnostic feature, as very thin and long extension of the anterior two spinous rays of first dorsal fin.

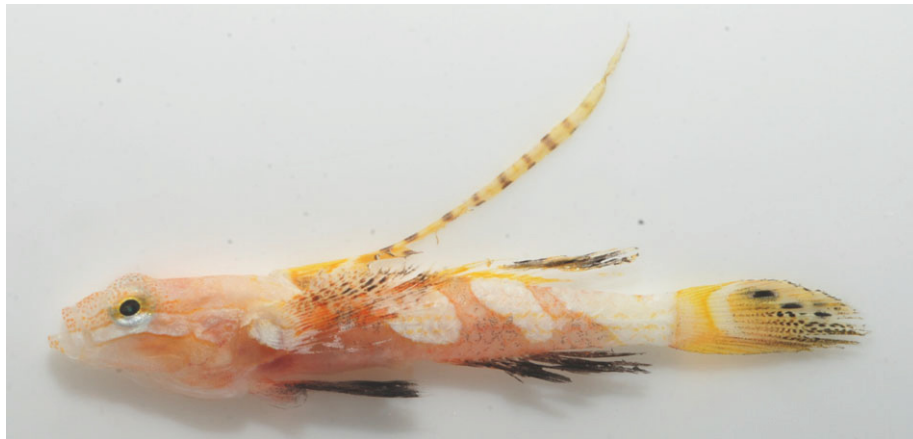


FIGURE 3. *Discordipinna filamentosa*, NSMT-P10437, male, holotype, 15.7 mm SL, Kumejima, the Ryukyu Islands, Japan. Photograph by Shih-Pin Huang.

Morphological comparison with the congeners. *Discordipinna filamentosa* n. sp. can be well distinguished from the type species, *D. griessingeri* Hoese & Fourmanior, 1978, in this genus by the following features: (1) fin ray counts: first dorsal fin rays VI vs. V; pectoral fin rays 16 vs. 17–20; (2) dorsal pterygoiphore formula 3/122101/9 vs. 3/41001/8; (3) dorsal fin shape: first ray of first dorsal-fin longest in male vs. second ray of dorsal-fin base longest in male; and its fin membrane simply pointed vs. biforked; (4) head canals: preopercular canal present vs. preopercular canal absent; and (5) specific coloration pattern: head with a horizontal white band vs. many round, deep black spots; pelvic fin with a snow-white oblique, wide band vs. unmarked pale white background; first dorsal fin with about 12 transverse brown bands vs. entirely orange red; and anal fin entirely black vs. with lower 2/3 region orange red and upper 1/3 region translucent.



FIGURE 4. Live underwater photograph of *Discordipinna filamentosa*, KPM-NR 38565, Okinawa Island, the Ryukyu Islands, Japan. Photograph by Yukinobu Adachi. 37 m depth, 3 Aug. 2000.

Although the difference of dorsal pterygoiphore formula between the two species can be observed, another shallow water species that resembles a *Discordipinna* (Gobiidae, indet. Gen and sp. 14 sensu Suzuki & Shibukawa 2004) also shares the same dorsal pterygiophore formula (3/122101/9) with *Discordipinna filamentosa*. These three species share a similar longitudinal pattern of infraorbital papillae which can be considered as an essential

feature for defining this gobioid genera (sensu Miller). The differentiation of the preopercular canal and dorsal pterygiophore formula may be considered as the potential features to separate them up to the generic level if there is further more morphological evidence likely from osteological survey. In addition, they share a reduced, longitudinal pattern of infraorbital sensory papillae and the feature of a restricted gill-opening, thus further anatomical and osteological evidences need to be gathered.

An artificial key to the species of *Discordipinna* in the Indo-Pacific region.

1. Preopercular canal absent; first dorsal fin rays V; distal membrane extension of first dorsal fin of male biforked (Indo-Pacific) *D. griessingeri*
- Preopercular canal present; first dorsal fin rays VI; distal membrane extension of first dorsal fin of male pointed 2
2. First dorsal fin of male extending far beyond vertical through caudal fin base when depressed; papillae of dorsal side behind orbit and lower corner of cheek below pore without long dermal projections; pelvic fin entirely black (Japan, Malaysia) *D. filamentosa* n. sp.
- First dorsal fin of male not extending to vertical through caudal fin base when depressed; papillae of dorsal side behind orbit and lower corner of cheek below pore with a pair of long dermal projections; pelvic fin 2–3 widely transverse snow white bands against black background (Ryukyus, Japan) *D. sp. 1*

Acknowledgments

We are very grateful for the great effort of the trawling team, especially Dr. P. K. L. Ng, Dr. N. Toru, Dr. T. Y. Chan, Dr. H. H. Tan, Dr. Z. Jaafar, Dr. Y. C. Liao, Mr. M. Y. Lee and Mr. S. P. Huang, for helping with the collections of several lots of deepwater gobies and taking specimen photographs in the 2009 Kumejima expedition. The author (ISC) wishes to thank the grant support from NSC, Taiwan and also the team project of marine biodiversity research from CMBB, NTOU and Academia Sinica. The author (TS) wishes to thank Mr. Y. Adachi and Dr. H. Senou (KPM) for providing the underwater gobiid images.

References

- Akihito, Prince, Hayashi, M. & Yoshino, T. (1984) Suborder Gobioidae. In: Masuada, H., Amaoka, K., Araga, C., Uyeno, T. & Yoshino, T. (eds) *The Fishes of Japanese Archipelago*. Tokai University Press, Tokyo, pp. 236–289.
- Akihito, Sakamoto, K., Ikeda, Y. & Sugiyama, K. (2002) Gobioidae. in Nakabo, T. [ed.] *Fishes of Japan with pictorial keys to the species*. English edition. Tokai University Press, Tokyo, pp. 1139–1310, 1596–1619.
- Chen, I.-S. & Fang, L.S. (2006) A new species of *Rhinogobius* (Teleostei: Gobiidae) from the Hanjiang basin in Guangdong Province, China. *Ichthyological Research*, 53, 247–253.
- Chen, I.-S. & Miller, P.J. (2008) Two new freshwater gobies of genus *Rhinogobius* (Teleostei: Gobiidae) in southern China, around the northern region of the South China Sea. *The Raffles Bulletin of Zoology*, Supplement 19, 225–232.
- Hagiwara, K., Ikeda, Y. & Hayashi, M. (1996) First record of the gobiid fish, *Discordipinna griessingeri* (Peciformes; Gobiidae) from Japanese waters. *I. O. P. Diving News* 7(8), 2–6. (In Japanese)
- Hoese, D.F. & Fourmanoir, P. (1978) *Discordipinna griessingeri*, a new genus and species of gobiid fish from the tropical Indo-West Pacific. *Japanese Journal of Ichthyology*, 25, 19–24.
- Miller, P.J. (1988) New species of *Corcyrogobius*, *Thorogobius* and *Wheelerigobius* from west Africa (Teleostei: Gobiidae). *Journal of Natural History*, 22, 1245–1262.
- Motomura, H. & Matsuura, K. [eds.] (2010) *Fishes of Yaku-shima Island*. National Museum of Nature and Science, Tokyo.
- Sanzo, L. (1911) Distribuzione delle papille cutanee (organi ciatiformi) e suo valore sistematico nei Gobi. *Mitteilungen aus der zoologischen Station zu Neapel*, 20, 249–328. (in Italian)
- Suzuki, T. & Shibukawa, K. (2004) Genus *Discordipinna* and Gobiidae indet. Gen. and sp. 14. in Senou, H. [ed.] *A Photographic Guide to the Gobioid Fishes of Japan*. Heibonsha, Tokyo, pp 443–444, 480–481. (in Japanese)